

SERVICE MANUAL
PHYSIOTHERM-S

Revision: 09 / 2008



PHYSIOMED®

TECHNOLOGY FOR THERAPY

Table of Contents

1	GENERAL	3
1.1	Packaging / Transport	4
1.1.1	Transporting the Unit	4
1.1.2	Unpacking the Unit	4
1.1.3	Packing the Unit	4
1.2	Notes on Safety	5
1.3	Service Principle	5
2	TECHNICAL DESCRIPTION	6
2.1	Technical Data	6
2.2	Circuit Description	7
2.3	Power Supply with PCB Input	7
2.4	PCB Power Supply	7
2.4.1	Power Setting – PCB Power Supply	9
2.5	HF Signal Generator	10
2.6	Preliminary Amplifier	10
2.7	Power Amplifier	10
2.8	Output Circuit	11
2.9	Operating Panel	11
3	MOUNTING AND DISMOUNTING ELEMENTS AND PARTS	12
3.1	Elements	12
3.2	Spare Parts	13
3.3	Opening and Closing the Unit	15
3.4	Exchanging PCB Controller, Display and Key Pad	16
3.5	Exchanging the Signal Generator and the Preliminary Amplifier	16
3.6	Exchanging the Power Amplifier	17
3.7	Exchanging the Output Circuit	17
3.8	Exchanging the Tuning Element	18
3.9	Exchanging the Power Switch	18

3.10	Exchanging the Power Supply	18
3.11	Exchanging the Anode/Control Transformer	19
4	SERVICE SETTINGS AND CHECKS	21
4.1	The Service Menu	21
4.1.1	Activating the Service Menu	21
4.2	Manufacturer recommendations on safety inspections according to 93/42 EEC	22
4.3	Visual Inspections and Function Checks	22
4.4	Setting the Output Power (PCB power supply)	23
4.5	Setting the Voltage of the Input Circuit	24
5	ERROR DIAGNOSIS PHYSIOTHERM-S	25

1 General

With **PHYSIOTHERM-S** you have acquired a high-quality and extremely versatile unit for short wave therapy. The most remarkable features of **PHYSIOTHERM-S** are its convenient operation and modern design as well as its easy maintenance and servicing and high degree of reliability.

The integrated safety functions for improving patient safety more than fulfill legal requirements. The unit is CE-labelled and thus meets the basic requirements laid down in the EC regulations for medical products.

Please note that this Service Manual was established on the basis of the Operating Instructions. Important notes on handling and operating the unit are contained in the Operating Instructions.

If your **PHYSIOTHERM-S** is in need of service, please contact:

PHYSIOMED ELEKTROMEDIZIN AG
Hutweide 10
D-91220 Schnaittach / Laipersdorf (Germany)
Phone +49 (0) 9126 2587-0
Fax +49 (0) 9126 2587-25

In case of technical problems or if you have technical questions, please contact your local distributor or the address mentioned above.

The unit may only be maintained by PHYSIOMED ELEKTROMEDIZIN AG or an authorized dealer.

If you ever need to return the unit to your dealer or to PHYSIOMED ELEKTROMEDIZIN AG, the **original packaging** needs to be used. The following information needs to be included:

- owner's name and address
- serial and device number
- description of the error (including error code)

1.1 Packaging / Transport

1.1.1 Transporting the Unit

In order to ensure safe transportation of **PHYSIOTHERM-S**, the original packaging should be used for transportation. This particular packaging offers the protection required for the transport of the unit in an **upright position**. Protection is not ensured for flat transportation, which may result in the unit being damaged and impaired in its function.

The authorized dealer or the owner is responsible for proper packaging and needs to ensure that all safety and accident prevention requirements are met.

1.1.2 Unpacking the Unit

The unit is generally delivered with the packaging material supplied by the manufacturer. Since the unit's weight is about 60 kg, it must be unpacked by at least two people!

Proceed as follows:

- Position the transport packaging so that the UP mark is pointing upward.
- Remove the safety straps from the transport packaging.
- Lift the upper part of the transport packaging and remove it from the unit.
- Remove the top part of the foam material.
- Lift (at least two people) the unit from the lower part of the packaging.

1.1.3 Packing the Unit

The unit should always be transported in its original packaging. Since the unit's weight is about 60 kg, it must be packed by at least two people!

Proceed as follows:

- Bend down both electrode arms.
- Affix the lower part of the transport packaging to the pallet.
- Place the bottom part of the foam material into the lower part of the transport packaging, the square cut-out facing up.
- Put the unit into the square cut-out (at least two people are required!) of the bottom part of the foam material.
- Pack all accessories separately. They may be placed in the space left by the unit (between the case and the operating panel) and shipped within the transport packaging.
- Place the protective cover (if available) over the unit.
- Now place the top part of the foam material over the unit.
- Put the upper part of the transport packaging over the unit packed in the foam material and slide it over the lower part of the packaging.
- Secure the complete packaging (upper + lower part of packaging + pallet) with safety straps.

1.2 Notes on Safety

Some parts within the unit are directly connected to the electric supply system. For some service work it may be required to operate **PHYSIOTHERM-S** while the unit is open and conduct measurements and settings. For this purpose, the usual safety regulations for preventing electric shock need to be observed.

During operation, voltages of up to several thousand volts are produced in the electric wiring system and the high frequency generator. In particular, the high-voltage supply unit, the tube power amplifier and the transformers may carry currents against electric earth that could result in electric shock.

For use of this Service Manual, knowledge of the Operating Instructions is required.

1.3 Service Principle

PHYSIOTHERM-S is of a modular design. All parts can be mounted and dismounted quickly. Electric and electronic modules are plugged in so that no soldering is required. In case an error occurs on a board or a module it will be replaced for a replacement charge, since repair of a board is usually not practicable on site. Repair is carried out at the manufacturer, if feasible. For this reason, no circuit diagrams of the modules are included in this Service Manual.

2 Technical Description

2.1 Technical Data

Mains connection	115 V / 230 V; 50-60 Hz set by voltage selector (anode and control transformer) within the unit	
Power line input	without HF output	approx. 200 VA
	with maximum output	approx. 1400 VA
Line fuse (unit)	16 A (115V)	8 A (230V)
Protection class	I	
Class acc. to EC 93/42	IIa	
Type	BF	
HF nominal power	1000 W pulsed mode (at pulse peak)	
	400 W continuous mode	
Power setting	10 W increments (CW mode)	
	50 W increments (pulsed mode)	
Power indication	Amplitude and effective power	
Working frequency	27.12 MHz +/- 0.6 %	
Pulse duration	200 - 600 µs	
Pulse frequency	10 - 300 Hz	
Treatment duration	1 - 60 min	
Design	IEC 601-1, IEC 601-2-3, IEC 601-1-2	
Weight	approx. 60 kg	
Dimensions in mm	420 x 970 x 405 (W x H x D)	
	conforms to European Council Directive concerning medical devices 93/42 EEC	

2.2 Circuit Description

The electric components of **PHYSIOTHERM-S** are located beneath the covering plate (operating panel) and on the boards for power supply; preliminary amplifier and signal generator are located behind the casing cover. The boards and all other electric components are connected via a plug connection and flat strip wires. The following functional blocks may be distinguished according to the block diagram on the following page.

2.3 Power Supply with PCB Input

Power is supplied via the mains supply. The supply voltage is directed to the power switch on the left side of the unit via the PCB input (**X1**).

Power is supplied via the PCB input to the no-heating appliance plug, the power switch and the anode and control transformers.

The voltage selectors for 115 V or 230 V operation are placed in sockets **X10** and **X3**.

Current limitation control transformer: via NTC resistor **R12**

Current limitation anode transformer: via resistor **R1/R2** and relay **K1**. After current limitation, the resistors are bridged by the switching contacts of relay **K1**. The LED **V3** indicates that the relay **K1** has been activated.

Switching anode voltage: via the relay **K2** on the primary side of the anode transformer. The LED **V4** indicates that the relay **K2** has been activated. The relay is controlled by the power supply via the terminal **X9**.

The anode transformer is connected to the terminals **X7** and **X8**. The **thermal switches** of the anode and control transformers are connected to the terminals **X7** and **X8**.

2.4 PCB Power Supply

The high voltage generated by the anode transformer is supplied via the terminals **X3** and **X5**.

In the lower range of performance (up to 280 W), the voltage amounts to 700 V AC, and to 1000 V AC in the upper range of performance (above 280 W).

High voltage is rectified, smoothed and increased by the factor 2.5.

Rectified high voltage in the lower range of performance: approx. 1,750 V DC (700 V x 2.5)

Rectified high voltage in the upper range of performance: approx. 2,500 V DC (1,000 V x 2.5)

The PCB power supply generates the grid voltage required for setting the operating point of the tube.

The PCB power supply also generates the rectified and stabilised supply voltages of 5 V, +/- 15 V, + 24 V and the unstabilised voltage of 50 V. These voltages are required for operating the individual modules.

Supply voltages at terminal strip **X4** (HF power output 0 Watt / cont.)

Pin (terminal strip)	Measuring point	LED	Voltage
1	MPP5VDC-A	-	4.8 V-5.2 V
2	MPP5VDC-AS	-	4.8 V-5.2 V
3	MPP5VDC-B	B3	4.8 V-5.2 V
4	MPP15VDC	B4	14.4 V-15.6 V
5	MPM15VDC	B5	-14.4 V-(-15.6 V)
6	MPP24VDC	B4	23 V-25 V
7	Earth	-	0 V
8	free	-	-
9	MPP50VDC	B4	49 V-55 V
10	Earth	-	0 V

Grid current measuring point at terminal strip **X1** (HF power output 400 Watt / cont.)

Pin (terminal strip)	Measuring point	Voltage	
1	Earth	0 V	
2	MPIG-A	0-100 mV	
3	free	-	
4	MPIG-B	0-100 mV	
5	Earth	0 V	


Measured with voltmeter between **PIN2** and **PIN4** (1 mV corresponds to 1 mA)

Anode current measuring point at terminal strip **X2** (HF power output 400 Watt / cont.)

Pin (terminal strip)	Measuring point	Voltage	
1	Earth	0 V	
2	MPIA-A	0-400 mV	
3	free	-----	
4	MPIA-B	0-400 mV	
5	Earth	0V	


Measured with voltmeter between **PIN2** and **PIN4** (1 mV corresponds to 1 mA)

Anode voltage measuring point at terminal strip **X28** (HF power output 0 Watt / cont.)

Pin (terminal strip)	Measuring point	Voltage	
1	Earth	0 V	
2	MPHV-DC	0-3 V	
3	Earth	0 V	


Measured with voltmeter between **PIN2** and **PIN3**.
Voltage reduced by factor 1000.

Cathode voltage measuring point at terminal strip **X23** (HF power output 0 Watt / cont.)

Pin (terminal strip)	Measuring point	Voltage	
1	Earth	0 V	
2	MPUCATODE-DC	0-12 V	
3	Earth	0 V	

Measured with voltmeter between **PIN2** and **PIN3**.
Voltage reduced by factor 10.

HF monitor at terminal strip **X7** (HF power output 0 Watt / cont.)

Pin (terminal strip)	Measuring point	Voltage	
1	MPHFMON2	0-5 V	
2	MPPREAMON2	0-5 V	
3	MPPAMON2	0-5 V	
4	Earth	0 V	

Measured with voltmeter between **PIN1**, **PIN2**, **PIN3** and **PIN4**.

2.4.1 Power Setting – PCB Power Supply

The power is set by means of the potentiometers **R89**, **R93**, **R97**, **R101** and **R105**. Please also refer to chapter 5.5: Setting the output power.

2.5 HF Signal Generator

A quartz oscillator supplies the operating frequency of 27.12 MHz. The quartz signal is amplified by approx. 30 dB (factor 1000). The power is set via a variable attenuator. The controller feeds the control signal for power regulation into the HF signal generator.

The HF power may be switched on and off by means of an HF switch. The HF switch is activated in accordance with the frequency of pulsed mode.

The power output of the HF signal generator is monitored continuously. The output power is displayed as **HF1** signal in the service menu.

In case of an error, the error code 30 will be displayed. Start the unit with the service menu and set the output power to approx. 50 W in CW operation. Check the **HF1** signal displayed in the service menu. If the value **HF1=0** is displayed, the signal generator is probably defective.

2.6 Preliminary Amplifier

The preliminary amplifier delivers an amplification of approx. 20 dB. The preliminary amplifier supplies the activation power required to the tube power amplifier.

The power output of the preliminary amplifier is monitored continuously. The output power is displayed as **HF2** signal in the service menu.

In case of an error, the error code 31 will be displayed. Start the unit with the service menu and set the output power to approx. 50 W in CW operation. Check the **HF2** signal displayed in the service menu. If the value **HF2=0** is displayed, the preliminary amplifier is probably defective.

2.7 Power Amplifier

The power amplifier amplifies the HF signal by approx. 10 dB (factor 10).

The power output of the power amplifier is monitored continuously. The output power is displayed as **HF3** signal in the service menu.

In case of an error, the error code 31 will be displayed. Start the unit with the service menu and set the output power to approx. 50 W in CW operation. Check the **HF3** signal displayed in the service menu. If the value **HF3=0** is displayed, the power amplifier is probably defective.

2.8 Output Circuit

A tuning capacitor is part of the output circuit. As the forward and reverse power is measured continuously, the tuning capacitor is able to adapt the signal to achieve optimum load conditions. A separate controller situated on the tuning element on the PCB evaluates the forward and reverse power values.

2.9 Operating Panel

The operating panel features a controller. The controller is responsible for controlling and monitoring the display, the programming menu, the service menu and the indications menu.

The forward and reverse power values are fed to the controller of the operating panel and are monitored by the controller. In case certain limits are exceeded, the controller issues an error code accordingly (refer to *Error Diagnosis PHYSIOTHERM-S* on page 25).

3 Mounting and Dismounting Elements and Parts

3.1 Elements

The unit is enclosed in a sheet steel housing of several parts.

PHYSIOTHERM-S contains the following parts:



Operating panel, PCB controller No. 11

Power switch No. 25

Output circuit No. 18

Power amplifier No. 17

Preliminary amplifier No. 19

PCB HF signal generator No. 14

PCB power supply No. 15

Control transformer No. 22

Anode transformer No. 21

PCB power input No. 16

Locking castor No. 31

Castor No. 30

3.2 Spare Parts

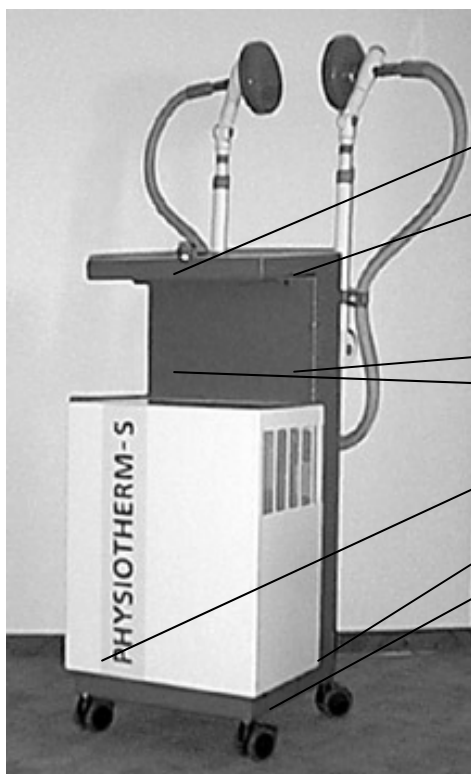
No.	Description
1.	Basic rack
2.	Case
3.	Control knob
4.	Control knob scale
5.	Cover PHYSIOTHERM-S
6.	Mounting plate for operating panel
7.	Cover high-voltage elements
8.	Display window
9.	Socket
10.	Connector socket
11.	PCB controller
12.	EPROM PSB controller
13.	EPROM indication controller
14.	PCB HF signal generator
15.	PCB power supply
16.	PCB power input
17.	Power amplifier
18.	Output circuit
19.	Preliminary amplifier
20.	Key pad
21.	Anode transformer
22.	Control transformer
23.	Incremental generator
24.	Display with connector
25.	Power switch
26.	Axial fan 24 V
27.	Appliance plug
28.	Fuse holder
29.	Fuse insert
30.	Castor

31.	Locking castor
32.	Coaxial connector
33.	Voltage selector 230 V
34.	Voltage selector 115 V
35.	4-pole cable form; power switch
36.	4-pole cable form; control transformer
37.	3-pole cable form; anode transformer
38.	Single-pole cable form; high voltage
39.	2-pole cable form; primary
40.	10-pole cable form; board connector
41.	20-pole flat cable; 800 mm
42.	9-pole cable form; secondary
43.	2-pole cable form; tube heater
44.	16-pole flat cable; 1200 mm
45.	2-pole cable form; primary
46.	34-pole flat cable; 1100 mm
47.	3-pole cable form; secondary
48.	5-pole cable form; terminal connector
49.	3-pole cable form; control cable
50.	9-pole flat cable; tuning element
51.	Single-pole cable form; terminal earth
52.	2-pole cable form; fan connector
53.	50 Ohm coax cable, BNC connector
54.	UHF cable

3.3 Opening and Closing the Unit

Disconnect the unit from power supply.

Opening the unit:



Taking off the cover:

Remove both Allen screws from the cover. Tilt the cover towards you and remove it.

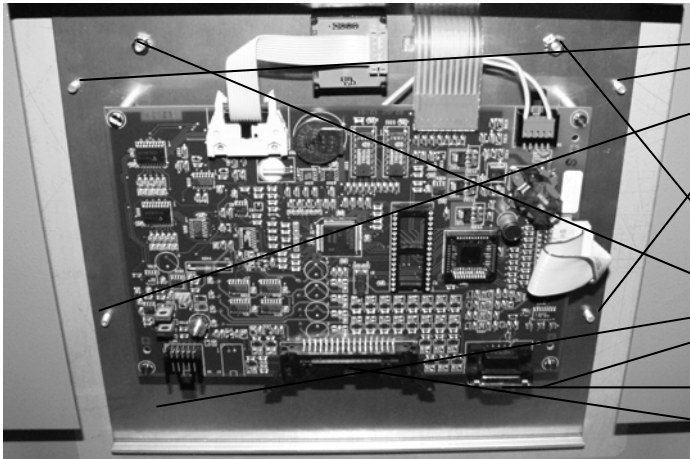
Taking off the case:

Remove both countersunk screws from the case. Remove the four Allen screws. Take off the case.

Closing the unit:

- Put the case back on the unit and fasten it by means of the countersunk screws (on top) and the Allen screws (at the side).
- The cover may now be put onto the pins on each side, tilted into its final position and fastened with both Allen screws to the brass spacing pins.

3.4 Exchanging PCB Controller, Display and Key Pad



Removing the cover:

Remove the four spacing pins from the cover. Remove the cover.

Removing the operating panel:

Remove both flat cables.
Remove the four nuts.
Remove the operating panel.
Remove the PCB controllers.

- Open the unit as described in chapter 3.3.
- Remove the cover of the operating panel.
- Remove the operating panel and the display as described in the figure above.
- Remove the keypad: Take off the cover. Remove the flat cable of the keypad from the operating panel board. Now you can remove the keypad from the cover plate.

3.5 Exchanging the Signal Generator and the Preliminary Amplifier



Preliminary amplifier (No. 19)

Preliminary amplifier input

Preliminary amplifier output

4 fastening screws of pre-amplifier

Signal generator PCB (No. 14)

Signal generator PCB input

Signal generator PCB output

5 fastening screws of signal generator

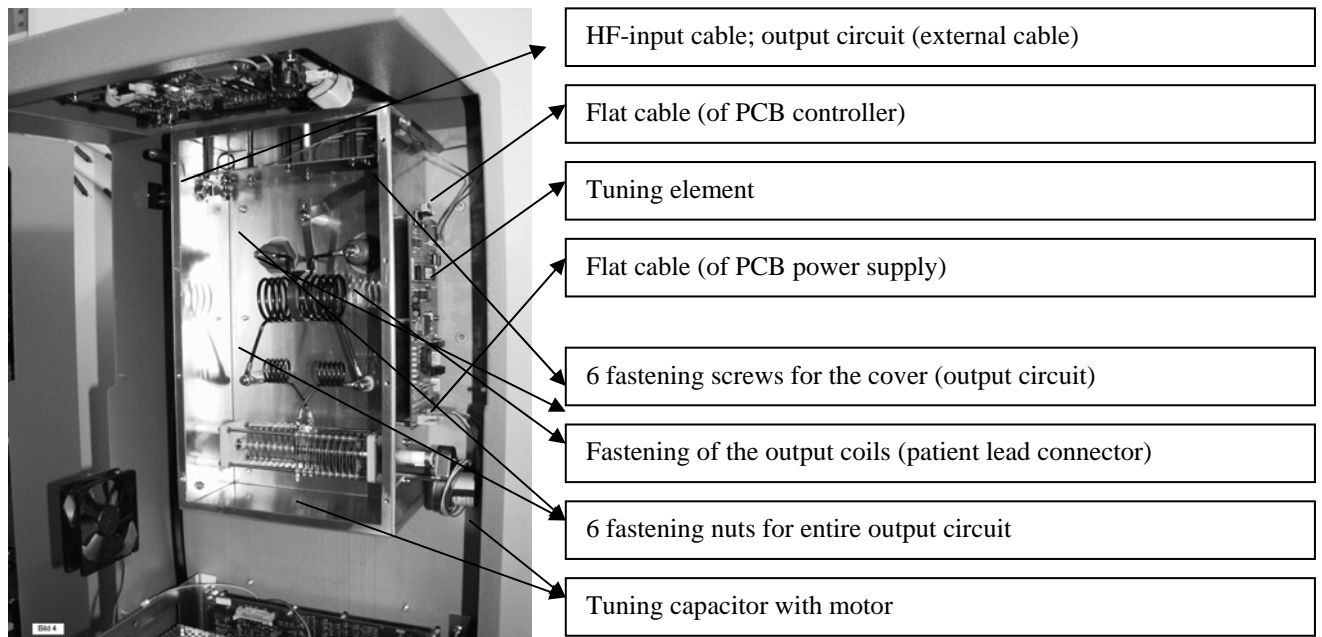
- Open the unit as described in chapter 3.3.
- Remove the input and the output connections.
- Remove the fastening screws (refer to figure).
- Remove the preliminary amplifier and the signal generator PCB from the holding pins.

3.6 Exchanging the Power Amplifier

Refer to the figure in chapter 3.1.

- **Disconnect the unit from the power supply.**
Caution: The power amplifier is under high voltage.
- Open the unit as described in chapter 3.3.
- Remove the two rear cheese head screws.
- Tilt the power amplifier towards you.
- Remove the connecting cables of the power amplifier (bottom).
- Remove the two front cheese head screws.
You can now remove the complete power amplifier.

3.7 Exchanging the Output Circuit



- **Disconnect the unit from the power supply.**
- Open the unit as described in chapter 3.3.
- Remove the two rear cheese head screws of the power amplifier.
- Tilt the power amplifier towards you.
- Remove the 6 fastening screws of the output circuit cover and take off the cover.
- Remove the output coils (refer to figure).
- Remove the 6 fastening nuts of the output circuit. You can now remove the entire output circuit from the fastening pins.

3.8 Exchanging the Tuning Element

- Remove the output circuit as described in chapter 3.7.
- Remove the three flat cables of the tuning element on the PCB.
- Remove both cable connectors of the directional coupler (upper left corner).
- Remove the 6 fastening screws from the board.
- Take out the complete board.

3.9 Exchanging the Power Switch

- **Disconnect the unit from the power supply.**
- Open the unit as described in chapter 3.3.
- Push out the power switch from the inside. If required hold down the snap-in pins at the top of the switch housing with a screwdriver while pushing out the switch.
- Put the new switch into the space provided for the power switch at the front. Ensure that the switch is inserted in the right position: "I" needs to be on top, "0" on the bottom.

3.10 Exchanging the Power Supply



High voltage element cover

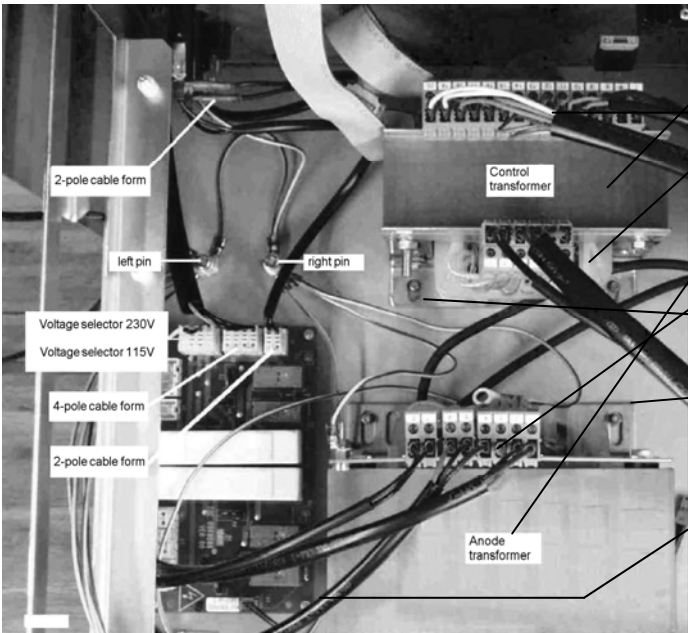
PCB power supply

4 fastening nuts for high voltage element cover

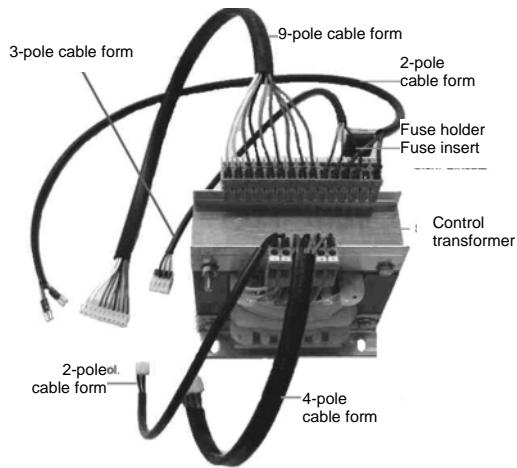
4 fastening nuts and 4 fastening pins for PCB power supply

- **Disconnect the unit from the power supply.**
- Open the unit as described in chapter 3.2.
- Remove the two rear cheese head screws of the power amplifier.
- Tilt the power amplifier towards you.
- Remove the four fastening nuts of the high voltage element cover.
- Take off the cover.
- Remove all connecting cables from the power supply. Make sure to remember the connections.
- Remove the four fastening nuts and four fastening pins of the PCB power supply.
- Remove the PCB power supply from the pins.

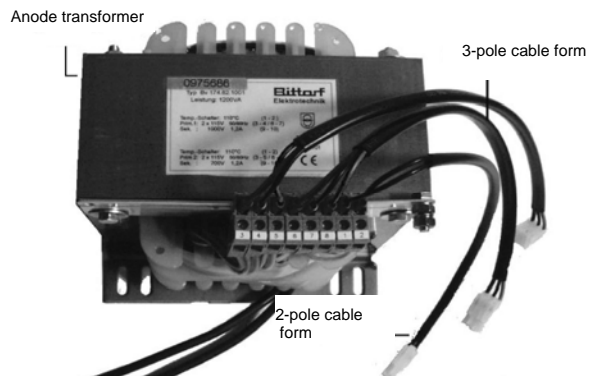
3.11 Exchanging the Anode/Control Transformer



- Control transformer No. 22
- Control transformer connections
- Anode transformer No. 21
- Anode transformer connections
- 4 fastening nuts of control transformer
- 4 fastening nuts of anode transformer
- PCB power input No. 16



Pin	Colour	Pin	Colour
1	black	11	blue
2	black	12	brown
3	red	13	brown
4	black	14	red
5	blue	15	red
6	brown	16	blue
7	red	17	black
8	free	18	blue
8	black	19	white
9	red	20	white
10	blue		



Pin	Colour
1	black
2	black
3	red
4	black
5	blue
6	red
7	black
8	blue

- **Disconnect the unit from the power supply.**
- Open the unit as described in chapter 3.3.
- Remove the power supply as described in chapter 3.10.
- Remove the cable form connections at the transformer connection pins.
- Remove the transformer.

4 Service Settings and Checks

4.1 The Service Menu

4.1.1 Activating the Service Menu

- Call up the basic settings menu (keep the data selector depressed while switching on the unit).
- Turn the data selector until the service code line is highlighted.
- Press the data selector. Set the **service code to 1310**.
- Select **Esc**, press the data selector and press **Esc** again. The service menu is activated (see image on the next page).
- Put a bucket filled with water between the plate electrodes.
- Set HF – power output to 150 Watt / cont.
- Fill in the measured values:

U1: _____ T1: _____ HF1: _____

U2: _____ T2: _____ HF2: _____

U3: _____ T3: _____ HF3: _____

The displayed values are important assessment criteria for our service department!

(You can print or copy this page to fill in the values.)

EFFECTIVE POWER		Output Power		0 W	
0.0W		Time		60 min	
MATCHING		Mode			
U1= 000		T1= 075		HF1= 000	
U2= 000		T2= 084		HF2= 000	
U3= 000		T3= 105		HF3= 000	
LT	RT	Hz	MODE	min.	W

Display	Significance
U1	Forward power
U2	Reverse power
U3	Adaptation value
T1	Temperature of preliminary amplifier
T2	Temperature of power amplifier
T3	Temperature of operating panel
HF1	Output power signal generator
HF2	Output power preliminary amplifier
HF3	Output power amplifier

Display	Significance
LT	Left hand rotation (tuning capacitor)
RT	Right hand rotation (tuning capacitor)
Hz	Frequency (pulsed mode)
Mode	Operating mode
min	Treatment duration
W	Output power

4.2 Manufacturer recommendations on safety inspections according to 93/42 EEC

The unit needs to undergo safety inspection at least every 24 months.

To do:

- (1) Check housing, power cable, electrode connection sockets, electrode cables, plate electrodes, diploides, diodes and rubber capacitor electrodes for deformations and damages.
- (2) Check indicators for correct function.
- (3) Check display of operating modes for correct function.
- (4) Check timer and time setting for accuracy (+/- 5s).
- (5) Check power switch for correct function.
- (6) Verify power output by means of a neon indicator.
- (7) Conduct an electrical test in accordance with IEC 601-1.

	Normal Condition	Single Fault Condition
7.1 Earth leakage current	$\leq 0.5 \text{ mA}$	$\leq 1.0 \text{ mA}$
7.2 Housing leakage current	$\leq 0.1 \text{ mA}$	$\leq 0.5 \text{ mA}$
7.3 Protective conductor resistance	100 mOhm	

4.3 Visual Inspections and Function Checks

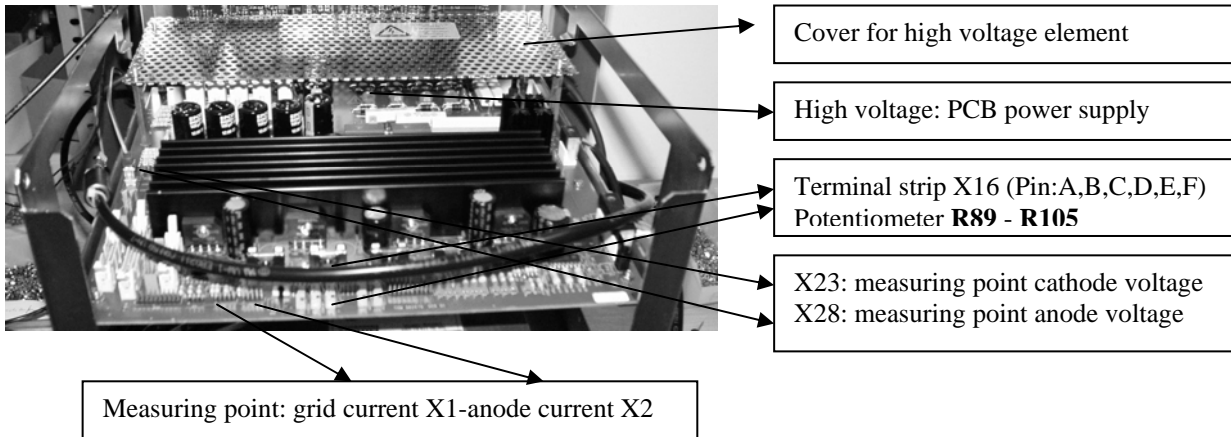
Visual inspections and function checks should be conducted after service work or a regular safety inspection has been performed. The following test equipment is required:

- Multifunctional measuring device
- Load: plastic bucket with water
- IEC 601-1 safety tester

Visual inspections and function checks are conducted as follows:

- Visually check the unit and accessories for mechanical damage that could impair function.
- Check fusible plug of the fuses for rated current and fusing characteristic.
- Check safety-related labels for readability.
- Check "turning incremental generator for power setting" for tightness. The turning knob should not touch the front foil.
- Check the BNC connector.
- Check the UHF connectors for tightness.
- Check whether all connectors are locked.
- Check pin connections for tightness.
- Check the high voltage protective cover of the PCB power supply.
- Check the earth conductor connections.

4.4 Setting the Output Power (PCB power supply)



Checking the output power:

- Place a bucket filled with water between the plate electrodes.
- Start the unit with the service menu.
- Compare the DC voltage values at the measuring points of the terminal strip **X16** to the values provided by the manufacturer in the test protocol (refer to table).

Switch off the HF power (0W).

If the test protocol is not available, contact PHYSIOMED ELEKTROMEDIZIN AG to obtain the correct voltage values.

	Terminal strip X16	Values from the test protocol	
R89	MPHFADJ-A	V	3-7V
R93	MPHFADJ-B	V	2-6V
R97	MPHFADJ-C	V	0-3V
R101	MPHFADJ-D	V	4-8V
R105	MPHFADJ-E	V	4-8V
	MPHFADJ-F	Earth	0V

- In case of deviations from the values specified in the test protocol, adjust them with the corresponding potentiometer.
- Turn up the output power to 150 W in continuous mode (CW).
- Check the following HF power values in the service menu and note the value for U1 in the test protocol.

CW:150W	HF1	> 50
CW:150W	HF2	> 50
CW:150W	HF3	> 50
CW:150W	U1	30-70 (with U3>60)

The forward power U1 indicates, that the HF output of the unit is under voltage.

- The exact HF output power may only be determined with an HF power meter.

4.5 Setting the Voltage of the Input Circuit

PHYSIOTHERM-S can be set to the two different mains voltages 115 V and 230 V, which are the most common systems worldwide. To change the voltage, the voltage selectors **X5** and **X10** located on the power input PCB need to be replaced by the corresponding other voltage selectors as well as the fuses in the mains connection socket.

- Open the unit as described in chapter 3.3.
- To change the voltage to 115 V remove the fuse holder from the fuse sockets and replace both fusible plugs (6x32 mm) by T16A (16A time-lag). Replace the voltage selectors **X5** and **X10**.

Conversion kit for 115 V

T16A: Fuse	No:975683
X5: Voltage selector	No:978307
X10: Voltage selector	No:978307

- To change the voltage to 230 V remove the fuse holder from the fuse sockets and replace both fusible plugs (6x32 mm) by T8A (8A time-lag). Replace the voltage selectors **X5** and **X10**.

Conversion kit for 230 V

T8A: Fuse	No:975682
X5: Voltage selector	No:978306
X10: Voltage selector	No:978306

- Correct or replace the label above the mains connection socket indicating the type of fuse inserted.
- Close the device and conduct a function and safety test.

5 Error Diagnosis PHYSIOTHERM-S

Error code	Possible cause	What to do
E1	Wrong electrode application.	Check the electrodes.
E2	Power setting over 100 W during tuning.	Please wait until tuning is finished.
E10	PCB signal generator defective or pulse or mode not correct.	Replace the PCB signal generator.
E11	Forward power exceeds the set value. A module is defective.	Restart the unit with the service menu. Set CW operation to 100 W – U1 below 90. Check the power regulation: Do the values HF1/HF2/HF3 and U1 change proportional to the set value? Check and change the modules, if required.
E12	Forward power remains below the set value. A module is defective.	Restart the unit with the service menu. Set CW operation to 100 W – U1 below 10. Check the power regulation: Do the values HF1/HF2/HF3 and U1 change proportional to the set value? Check the modules.
E13	Reverse power exceeds the forward power significantly. Measuring line tuning element - directional coupler may be defective.	Restart the unit with the service menu. Set the CW operation to 100 W. Check U1 and U2.
E14	Error reading the basic settings (contrast, luminosity, language, volume, pulse length)	Replace EEprom D300 / 24LC16V or exchange PCB controller
E15	Error reading the operating hours counter	Update to software version 1.25 or replace EEprom D300/ 24LC16V
E20	Preliminary amplifier overheated. Fan defective.	Restart the unit with the service menu. Check temperature T1 (max. 180). Let the unit cool down. If the temperature (with max. power) rises again after a short while: preliminary amplifier may be defective.
E21	Power amplifier overheated. Fan defective.	Restart the unit with the service menu. Check temperature T2 (max. 140). Let the unit cool down. If the temperature (with max. power) rises again after a short while: power amplifier may be defective.
E22	Operating panel overheated.	Restart the unit with the service menu. Check temperature T3 (max. 140). Let the unit cool down. If the temperature rises again after a short while: PCB controller may be defective.
E23	Short-circuit in the NTC preliminary amplifier (T1 > = 184).	Exchange the preliminary amplifier.
E24	Interruption in the NTC preliminary amplifier (T1 < = 4).	Exchange the preliminary amplifier.
E25	Short-circuit in the NTC power amplifier (T1 > = 184).	Exchange NTC and power amplifier if required.
E26	Interruption in the NTC power amplifier (T1 < = 4).	Exchange NTC and power amplifier if required.
E27	Short-circuit in the NTC controller (T1 > = 184).	Exchange PCB controller.
E28	Interruption in the NTC controller (T1 < = 4).	Exchange PCB controller.

Error code	Possible cause	What to do
E30	Signal generator defective. (Note: Invalid from software version 1.23 PSD. Is replaced by Error 12.)	Signal generator does not generate any output power (HF1=0). Exchange the signal generator.
E31	Preliminary amplifier defective. Fuse F10 (4AT) defective. (Note: Invalid from software version 1.23 PSD. Is replaced by Error 12.)	LED B7 is not alive ⇒ Exchange fuse F10 (4AT). Preliminary amplifier does not deliver any output power (HF2=0). Exchange the preliminary amplifier.
E32	Power amplifier defective. (Note: Invalid from software version 1.23 PSD. Is replaced by Error 12.)	Power amplifier does not deliver any output power (HF3=0). Check anode voltage ⇒ X28 (power supply): approx. 1.8 V DC. Check cathode voltage ⇒ X23 (power supply): approx. 0.9 V DC. Check heating voltage ⇒ X35 (PCB distributor on power amplifier): approx. 4.8 V AC. Exchange power amplifier if required.
E33	HF monitoring defective. (Note: Invalid from software version 1.23 PSD. Is replaced by Error 12.)	Restart the unit with the service menu. Check HF1/HF2 and HF3 without power (P=0W). PCB controller may be defective (if HF1/HF2 and HF3 = 0)
E34	Tuning element or PCB controller defective.	Exchange defective PCB.
E39	(Not used)	
E40	CPU clock defective (wrong quartz).	Check or replace quartz or exchange PCB controller.
E41-E42	(Not used)	
E49	Short circuit of STOP button (or button is pushed when switching on the instrument)	Restart the instrument without pressing the STOP button; or replace the STOP button.
E50-E56	(Not used)	
E57	Watchdog does not trigger a RESET; MAX691 is defective	Replace IC MAX691 or exchange PCB controller.
E58	External RAM defective (does not store data)	Replace PSD312 or exchange PCB controller.
E59	Wrong checksum PSD312	Replace PSD312 or exchange PCB controller.
Display remains black	No supply voltage.	Check the mains supply.
	Mains cable not plugged in or not plugged in properly in socket or on the unit.	Check connection of the mains cable.
Power switch is on but display remains black	Thermal switch in the anode/control transformer might have been triggered.	Let the unit cool down.
	Fuses may be defective.	Check the fuses of the unit's mains connection and replace if required. Check the mains voltage specifications on the back of the unit and select another voltage as described in chapter 4.5.

part number / O-No	description / ND	step/cost	perpos.no.	item notice	quantity
p.ID: 00045 var./sw: 0/0-0-0 desc 1/2: Kurzwelle PHYSIOTHERM-S inkl. Standardzubehör O#: 968983 desc 3/4: ND: PHYSIOTHERM-S desc 5/6: Ersteller: Raum desc 7/8:					
51483	[¶] Neon tube	1	1	10	1,0000
51484	[¶] Power amplifier cpl.	1	1	20	1,0000
51485	[¶] Output circuit cpl.	1	1	30	1,0000
51486	[¶] Preamplifier cpl.	1	1	40	1,0000
51487	[¶] PCB Controller	1	1	50	1,0000
51488	[¶] PCB HF-Signal generator	1	1	60	1,0000
51489	[¶] PCB Power supply	1	1	70	1,0000
51490	[¶] PCB Mains input	1	1	80	1,0000
51491	[¶] Anode transformer	1	1	90	1,0000
51492	[¶] Main transformer	1	1	100	1,0000
51493	[¶] Display	1	1	110	1,0000
51494	[¶] Power switch	1	1	120	1,0000
51495	[¶] Fuse T8 A for 230V	1	1	130	1,0000
51496	[¶] Voltage selector for 230V	1	1	140	2,0000
51497	[¶] Fuse T16 A for 115 V	1	1	150	1,0000
51498	[¶] Voltage selector for 115 V	1	1	160	2,0000

